4.7 Test Reactor Area

Since the early 1950s, the Test Reactor Area (TRA), located in the south-central portion of the INEEL Site, has provided facilities for operation of experimental nuclear reactors, physics and chemistry laboratories, administrative space, and other plant support. There are currently 89 buildings at TRA, ranging in age from those built in the early 1950s to newly constructed buildings and structures (see Figure 4-7).

Figure 4-7. Aerial view of the Test Reactor Area.

Three major reactors have been built at TRA, including the Materials Test Reactor (MTR), the Engineering Test Reactor (ETR), and the Advanced Test Reactor (ATR). An additional reactor, the ATR Criticality Facility at TRA, is a full-scale, low-power version of the ATR designed to provide physics data. The Materials Test Reactor and Engineering Test Reactor are no longer operational.

The primary mission of TRA is continued operation of the ATR, the world's largest test reactor, which is used to conduct irradiated material testing, nuclear safety research, and nuclear isotope production. The ATR's current primary mission is reactor fuels and core component development and testing for the Naval Nuclear Propulsion Program. The ATR also will continue its long-term mission of radioisotope production for medical, industrial, and research applications. The ATR is planned to provide major support in the development of next-generation nuclear power systems and other advanced nuclear technologies. In addition to the ATR, several other significant nuclear operations are conducted at the TRA, which include radiochemistry laboratory operations, hot cell operations, and the Safety and Tritium Applications Research Program.

TRA was designated as WAG 2 (OU 2-13) in the FFA/CO. The main sources of contamination at TRA include the Warm Waste Pond, the Chemical Waste Pond, and the Sewage Leach Pond. Seepage from these infiltration ponds and the injection well contaminated groundwater beneath TRA, principally with chromium and tritium.

Fifty-five sites of known or suspected contaminant release at TRA were evaluated in the *Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1997a). The *Final Record of Decision, Test Reactor Area, Operable Unit 2-13* (DOE-ID 1997b) determined that four sites would require active action and that four sites would require limited action. The remaining 47 sites were determined to require no further action. The *Explanation of Significant Differences to the Record of Decision for Test Reactor Area Operable Unit 2-13* (DOE-ID 2000d) identified seven of the 47 sites, which were listed previously as no action sites, requiring specific institutional controls to prevent a possible threat to human health and the environment. These seven sites along with the eight sites identified as requiring action in the *Final Record of Decision, Test Reactor Area, Operable Unit 2-13* (DOE-ID 1997b) bring the total number of sites requiring institutional controls to 15.

Two earlier RODs for TRA were the *Record of Decision: Test Reactor Area Perched Water System, Operable Unit 2-12* (DOE-ID 1992e) and the *Declaration of the Record of Decision for the Warm Waste Pond at the Test Reactor Area at the Idaho National Engineering Laboratory* (DOE-ID 1991b).

4.7.1 Current State

A current state map of TRA is included as Figure 4-7a1. A current state conceptual site model for TRA is included as Figure 4-7a2.

The ETR and MTR have both been deactivated. Both facilities have been defueled, but the reactor vessels are still in place. Cleanup of the MTR canal is in progress. The ETR building is currently not being used. The MTR building is currently used for a variety of activities including office space, special projects, and warehouse facilities. Cleanup activities at the ETR and MTR buildings are scheduled to be complete by 2020.

There are still a number of open VCO actions at TRA, which involve characterization of tanks and tank systems and RCRA closures. These are all scheduled to be complete by 2012.

The active remediation work for OU 2-13 was completed in December 1999. Remedial actions include consolidating and capping contaminated sediments, removing contaminated materials, implementing institutional controls, and monitoring the decrease of contamination in groundwater through radioactive decay, dispersion, and natural attenuation. The *First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003c) found that remedies are performing as expected and are continuing to provide protection of human health and the environment. Potential short-term threats are being addressed through institutional controls. In the long term, the remedies are expected to be protective when groundwater cleanup goals are achieved through monitored natural attenuation.

There are currently 15 sites where institutional controls are in place because residual contamination precludes unrestricted access. These sites include the covered Warm Waste Pond (TRA-03); the covered Chemical Waste Pond (TRA-06); the covered Sewage Leach Pond (TRA-13) and surrounding soil contamination area (TRA-13SCA); the operating Cold Waste Pond (TRA-08); the Soil Surrounding Hot Waste Tanks at TRA-613 (TRA-15); the soil surrounding Tanks 1 and 2 at TRA-630 (TRA-19); the Brass Cap Area (TRA-Y); the Warm Waste Retention Basin (TRA-04); three polychlorinated biphenyl spill sites at TRA-619, TRA-626, and TRA-653; the North Storage Area (TRA-34); the Hot Tree Site (TRA-X); and Perched and Snake River Basin Aquifer Groundwater (TRA-GW). The sites are shown on Figure 4-7a1.

Active remediation was conducted at four pond sites: the Cold Waste Pond, the Warm Waste Pond, the Chemical Waste Pond, and Sewage Leach Pond and Berm. The Cold Waste Pond (TRA-08) is still in use today. In 1999, approximately 80 yd^3 of cesium-137 contaminated soil were removed from this site and transported to the Warm Waste Pond for disposal. The Chemical Waste Pond (TRA-06) was covered with an engineered soil cover that was reseeded with native vegetation to control erosion. There are no restrictions on industrial land use at these two sites. The Warm Waste Pond (TRA-03) was capped with an engineered soil cover and covered by a 2-ft-thick riprap layer to inhibit human intrusion. The Sewage Leach Pond and Berm (TRA-13) were remediated by excavation of soil contaminated with cesium-137 concentrations greater than 23.3 pCi/g from the berms and by placement of contaminated soil in the bottom of the Sewage Leach Pond. The area was then covered with an engineered soil cover and reseeded with native vegetation to control erosion. TRA-03 and TRA-13 both require institutional controls to control occupational access and activities for more than 30 years.

The four limited-action sites include TRA-15, TRA-19, TRA-Y, and TRA-13SCA. Actions taken at these sites were limited to institutional controls, with a contingent excavation and disposal option for TRA-19 and the Brass Cap Area to be used if necessary. The institutional controls include restricting occupational access and prohibiting residential use. This is accomplished through restricted access to the INEEL Site, warning signs at contaminated areas, and control of activities (drilling and excavation).

The remaining seven sites are under institutional control to restrict access until contaminant concentrations decrease to levels that allow for unlimited use and unrestricted access. For most of these sites, the institutional controls restrict use of the sites to industrial land use only for varying periods of time. The three polychlorinated biphenyls contaminated sites were remediated in 1990 to remove polychlorinated biphenyls contaminated soil to meet the 25-ppm limit for industrial sites defined by Toxic Substances Control Act requirements. Residual contamination at these sites is below Toxic Substances Control Act levels for industrial areas but greater than the 10-ppm requirement for unrestricted use. Therefore, permanent institutional controls are required to prohibit future residential use.

There are three water bodies beneath TRA: (1) a shallow-perched water zone, (2) a deep-perched water zone, and (3) the Snake River Plain Aquifer. The selected remedy for TRA groundwater was “no action with monitoring.” The *Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12* (Dames & Moore 1993) specified that sampling and analysis for all COCs would be performed quarterly for six deep-perched water wells and semiannually for four aquifer wells.

The primary COCs identified for the aquifer are chromium and tritium. Tritium levels in all aquifer wells are below the MCL and are expected to continue to decrease because of radioactive decay and dilution. Measured concentrations of chromium levels currently exceed the MCL (100 μg/L) in two wells. The unfiltered chromium levels are approximately 160 μg/L in TRA-07 and approximately 130 μg/L in USGS-065. The chromium levels have shown a decreasing trend since 1990 and are expected to decline below the MCL by 2012 for all wells. This projection is supported by groundwater data collected and summarized in the *First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003c).

Groundwater modeling completed before signing of the OU 2-12 ROD (DOE-ID 1992e) predicted the dissipation of perched water within 7 years following cessation of discharge to all disposal ponds. The new mission for the INEEL, which will keep TRA operational for at least another 20 years, will cause perched water to persist beneath TRA beyond the modeling assumptions used in the risk assessment. The primary source of water to the perched water system, the Cold Waste Pond, receives only uncontaminated effluent. There has been a general decreasing trend in concentrations for chromium, tritium, strontium-90, and cobalt-60 in the perched water zone. Exceptions to the general decreasing trend include increasing or

flat activities of strontium-90 in four perched water wells and a recent increase of cobalt -60 in one well. Because of the high Kd (i.e., soil-water partitioning coefficient) values of these contaminants and the fact that pre-ROD modeling used similar concentrations in perched water to model impact to the aquifer, it seems unlikely that the downward transport of perched water containing strontium -90 or cobalt-60 could significantly impact the aquifer in the short term. Diesel was discovered during drilling of one well during the remedial investigation in 1990. Product floating on the deep-perched water body has been observed in this well intermittently since that time, and it has been the subject of several investigations. The results of the modeling determined that the diesel did not pose an unacceptable risk to the aquifer. However, the source and aerial extent of the diesel plume have never been fully characterized, and it was determined during the first 5-year review that additional characterization of this problem is warranted. Ongoing discussions with the agencies will define activities to fully evaluate the perched water contamination and long-term impacts on the aquifer given that TRA operations are expected to continue for at least another 20 years.

Additional detailed information on current state conditions at TRA is available from the *First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003c).

4.7.2 End State

A map showing TRA at the 2035 end state is provided as Figure 4-7b1. It is anticipated that institutional controls at the following sites will be discontinued within 30 years:

- TRA-04 (the Warm Waste Retention Basin surficial sediments)
- TRA-06 (the Chemical Waste Pond)
- TRA-08 (the Cold Waste Disposal Pond)
- TRA-34 (soil at North Storage Area)
- TRA-X (soil contamination at Hot Tree Site).

Institutional controls will be maintained at the Warm Waste Pond and the Sewage Leach Pond. The Sewage Leach Pond (TRA-13) will require controls through approximately 500 years. TRA-03 (the Warm Waste Pond) will require controls for 100 years because of radioactive contamination. Institutional controls at these sites include warning signs, control of activities (drilling or excavating), and notice to affected stakeholders. Institutional controls at TRA-15, TRA-19, TRA-Y, TRA-13SCA, and the three polychlorinated biphenyl contaminated sites still will be required at completion of the EM cleanup mission. TRA-13SCA and TRA-15 are expected to be available for unrestricted industrial use at that time, but controls still will be needed to prohibit residential use.

A conceptual site model for TRA at the risk-based end state is provided as Figure 4-7b2.

NE is now designated the LPSO and has assumed ownership of most of the buildings at TRA. NE will determine which of the buildings will be needed for future missions. Since TRA will have a long-term nuclear mission, Figure 4-7b1 shows all of the current state facilities and structures although it is possible that some TRA buildings may be decommissioned before the end of the EM mission.

4.7.3 Variances

No potential variances have been identified for TRA, as all active remediation work has been completed.

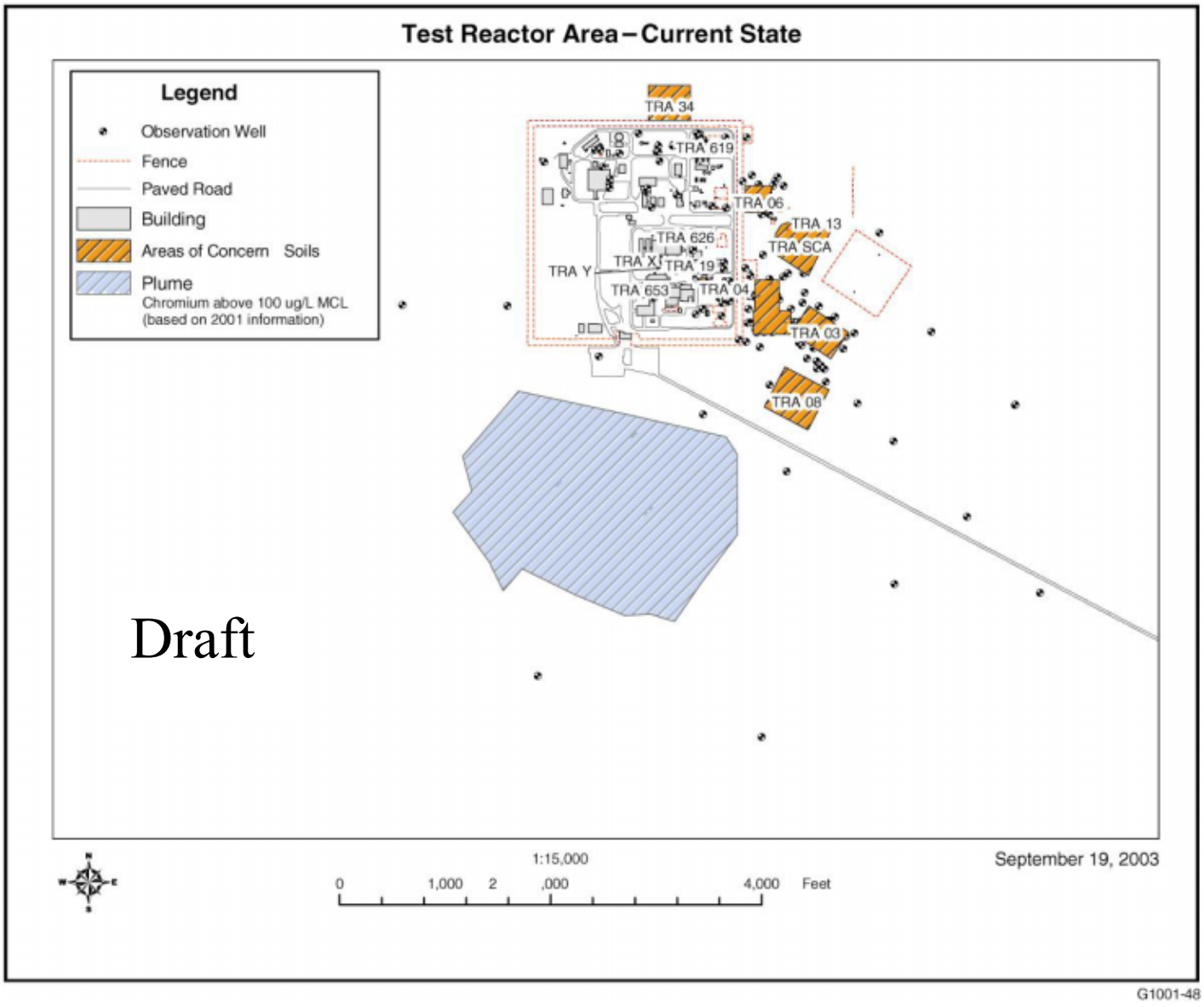

Figure 4-7a1. Test Reactor Area map—current state.

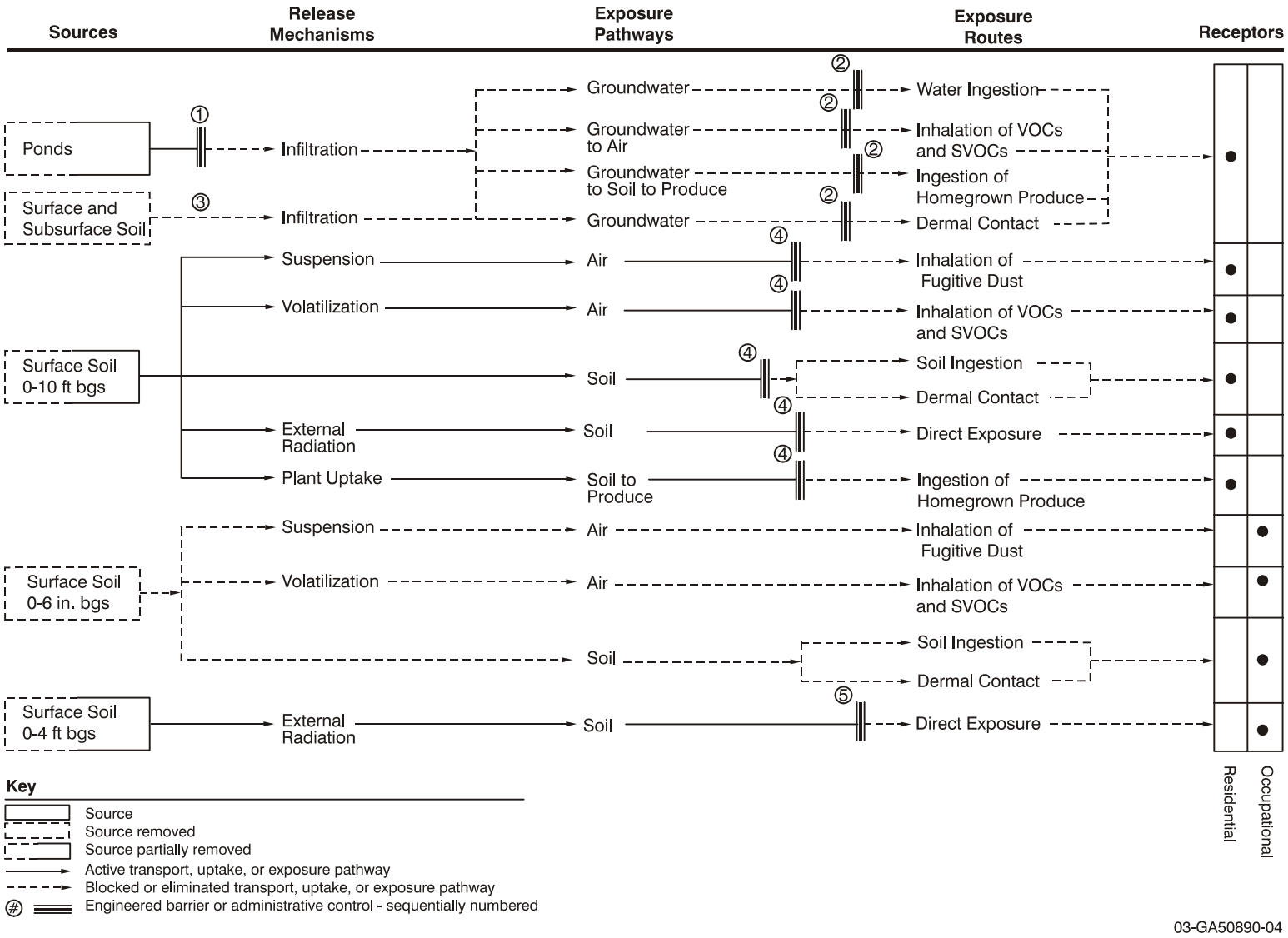

Figure 4-7a2. Test Reactor Area conceptual site model—current state.

SVOC = semivolatile organic compound

Narrative for Figure 4-7a2 Test Reactor Area Conceptual Site Model—Current State

All active remedial actions required by the OU 2-13 ROD (DOE-ID 1997b) have been completed. During the first 5-year remedy effectiveness review for OU 2-13 conducted in 2003, it was found that the remedies are performing as expected and are continuing to provide protection of human health and the environment (DOE-ID 2003c).

Institutional controls are in place because residual contamination precludes unrestricted access in the following 15 areas:

- Three out-of-service, covered pond sites (TRA-03 Warm Waste Pond, TRA-06 Chemical Waste Pond, and TRA-13 Sewage Leach Pond) and one operating pond, the TRA-08 Cold Waste Pond
- Three sites with polychlorinated biphenyl contamination that have been cleaned up to meet Toxic Substances Control Act requirements
- Seven sites with residual radionuclide contamination in subsurface soil (i.e., TRA-13SCA, TRA-15, TRA-19, TRA-Y, TRA-04, TRA-34, and TRA-X)
- Contamination in perched water zones and the Snake River Plain Aquifer (TRA-GW).

The steps taken to mitigate or remove these hazards are as follows:

1. The selected remedy for the Warm Waste Pond (TRA-03) was containment by capping. This pond was capped with an engineered soil cover with a 2-ft-thick layer of riprap. Before capping, this site was used as a disposal facility for contaminated soil from other parts of the INEEL. The Chemical Waste Pond (TRA-06) was capped with an engineered soil cover and revegetated. Mercury contamination is present at depths below 14 ft. The Sewage Leach Pond and Berm (TRA-13) were remediated by removing soil contaminated with cesium-137 at concentrations greater than 23.3 pCi/g from the berms, placing the contaminated soil in the pond basin, and covering the pond with a 10-ft-thick engineered soil cover. The Cold Waste Pond was remediated by removing soil contaminated with cesium-137 from the basin and disposing of the contaminated soil in the Warm Waste Pond. This pond is still in use for disposal of uncontaminated wastewater. Contamination in the groundwater is being remediated through monitored natural attenuation, radioactive decay, and dispersion.

2. Long-term institutional controls are in place for all four ponds. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities.

3. All surface and subsurface soil with potential to impact the groundwater has been removed.

4. Areas with residual soil contamination that still present unacceptable risk to hypothetical residential receptors include three sites with polychlorinated biphenyl contamination (TRA-619, TRA-626 and TRA-653). The residual polychlorinated biphenyl contamination at these sites is below the 25-ppm action level defined by Toxic Substances Control Act requirements but above the 10-ppm cleanup level that would be required for residential use of the sites. Permanent institutional controls to prevent residential use of these sites are required.

   There are also a number of sites with residual radionuclide levels. TRA-15, TRA-19, TRA-Y, TRA-04, TRA-34, and TRA-X all currently require institutional controls to protect potential residential receptors. Institutional controls consist of restricted access to prevent intrusion by the public and warning signs.

5. Areas with residual soil contamination that require institutional controls to protect occupational receptors include TRA-15, TRA-19, and the soil contamination area in the vicinity of the Sewage Leach Pond (TRA-13). The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities.

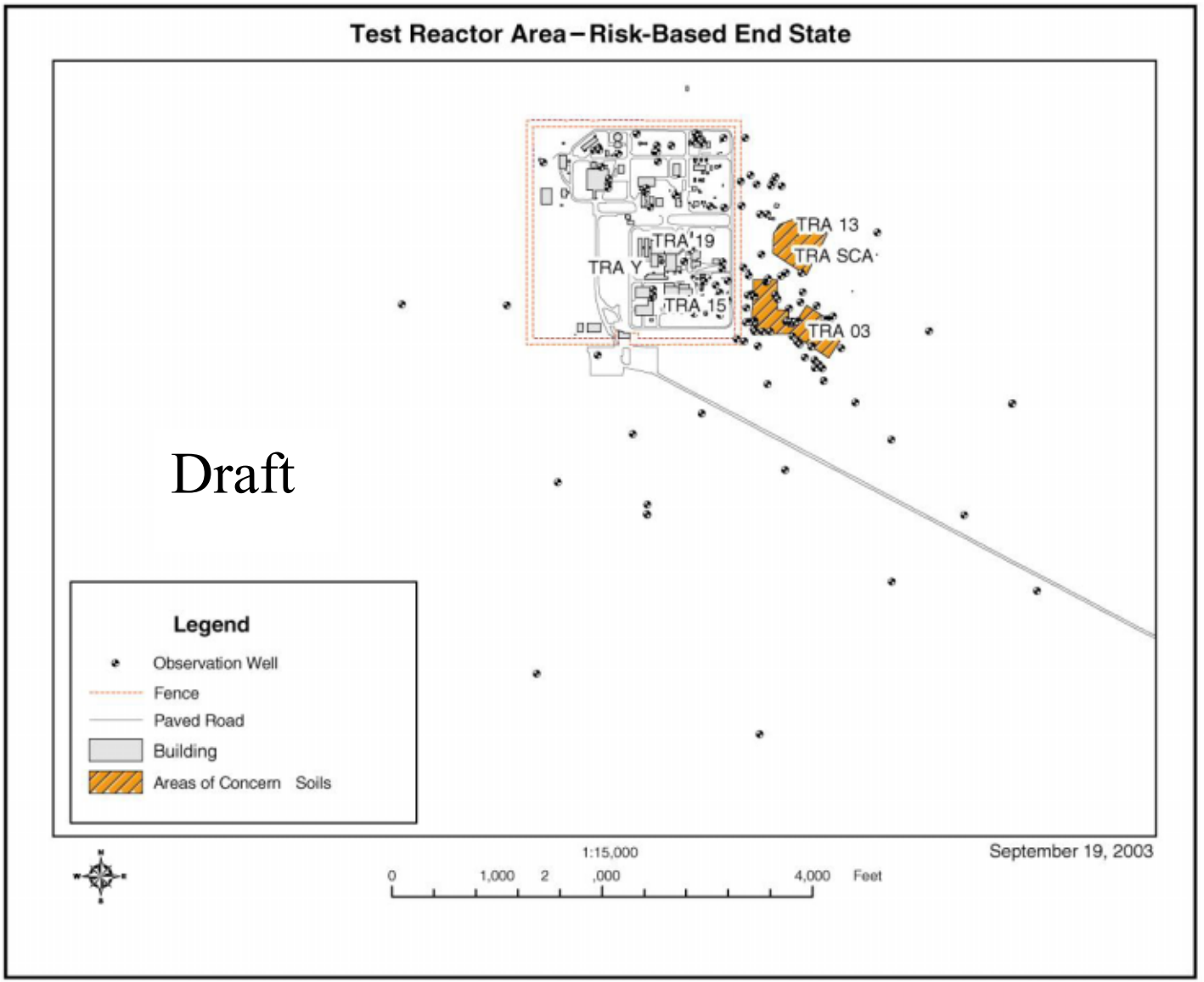

Figure 4-7b1. Test Reactor Area map—risk-based end state.

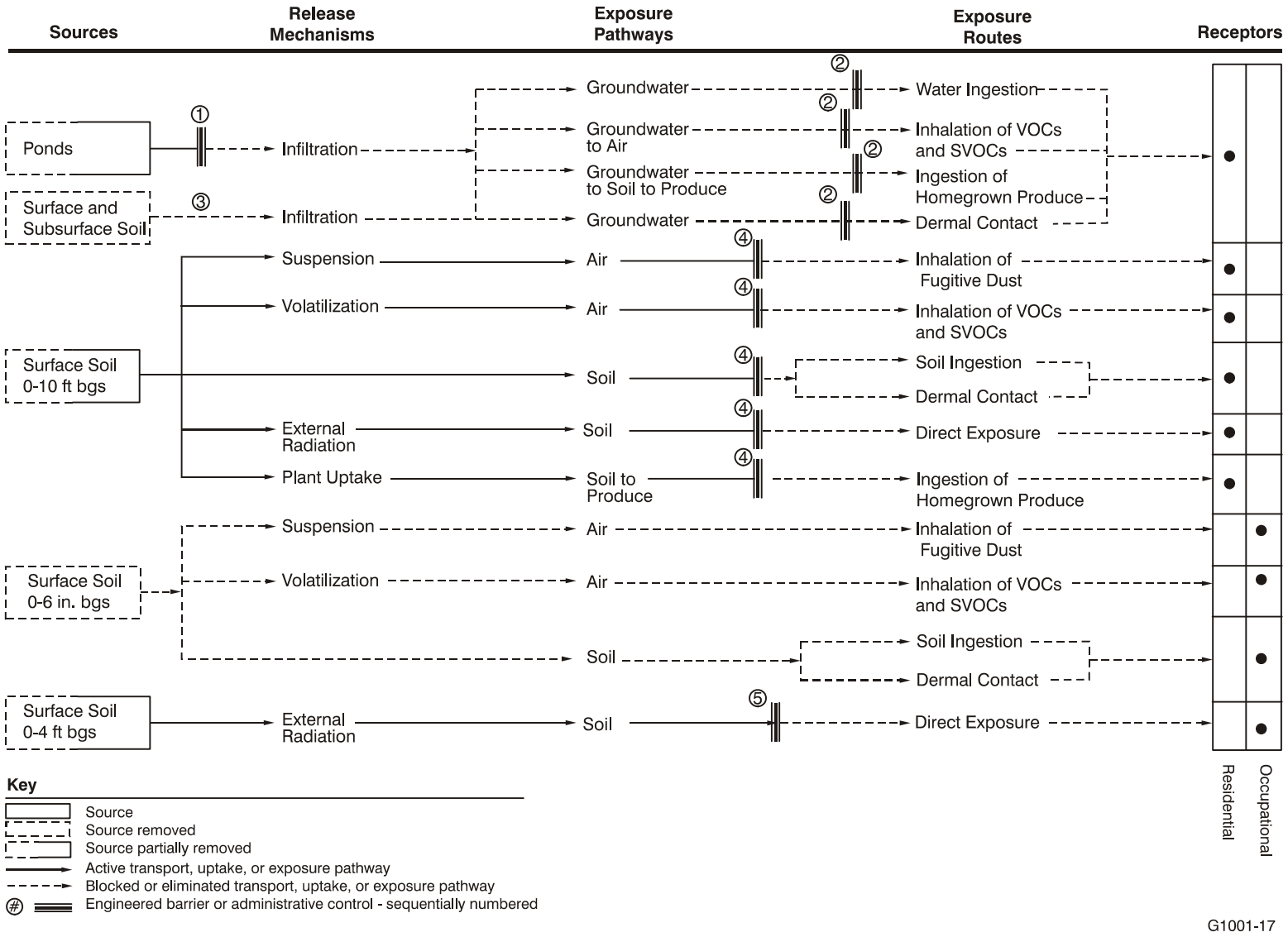

Figure 4-7b2. Test Reactor Area conceptual site model—risk-based end state.

SVOC = semivolatile organic compound

Narrative for Figure 4-7b2 Test Reactor Area Conceptual Site Model—Risk-Based End State

Chromium concentrations in the groundwater will be below MCLs before 2035. It is anticipated that the following sites still will require institutional controls because of residual contamination:

- Two out-of-service, covered pond sites, TRA-03 Warm Waste Pond and TRA-13 Sewage Leach Pond, will require institutional controls for 100 years and 500 years, respectively, because of residual radionuclides.
- Three sites with polychlorinated biphenyl contamination that have been cleaned up to meet Toxic Substances Control Act requirements will require permanent institutional controls to preclude residential use. (Industrial use is unrestricted.)
- Four sites with residual radionuclide contamination in subsurface soil include TRA-13SCA, TRA-15, TRA-19, and TRA-Y.

The steps taken to mitigate or remove these hazards are as follows:

1. The Warm Waste Pond (TRA-03) was capped with an engineered soil cover with a 2-ft-thick layer of riprap. Before capping, this site was used as a disposal facility for contaminated soil from other parts of the INEEL. The Sewage Leach Pond and Berm (TRA-13) were remediated by removing soil contaminated with cesium-137 at concentrations greater than 23.3 pCi/g from the berms, placing the contaminated soil in the pond basin, and covering the pond with a 10-ft-thick engineered soil cover.
2. Long-term institutional controls will need to be maintained at TRA-03 and TRA-13 to protect hypothetical residential receptors. The entire INEEL Site has restricted access to prevent intrusion by the public.
3. All surface and subsurface soil with potential to impact the groundwater has been removed.
4. Areas with residual soil contamination that will still present unacceptable risk to hypothetical residential receptors at the end state include three sites with polychlorinated biphenyl contamination (TRA-619, TRA-626, and TRA-653). The residual polychlorinated biphenyl contamination at these sites is below the 25-ppm action level defined by Toxic Substances Control Act requirements but above the 10-ppm cleanup level that would be required for residential use of the sites. Permanent institutional controls to prevent residential use of these sites will be required.

   It is expected that TRA-13SCA, TRA-15, TRA-19, and TRA-Y will still require institutional controls to protect potential residential receptors. (Continued need for institutional controls is evaluated through the 5-year reviews.) Institutional controls consist of restricted access to prevent intrusion by the public and warning signs.
5. Areas with residual soil contamination that will probably still require institutional controls to protect occupational receptors will include TRA-19 and TRA-Y. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities.